

**MONEY DEMAND ANALYSIS IN INDONESIA: THE SVAR APPROACH**

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This study aims to analyze the response of demand for money to shocks in macroeconomic variables such as income, inflation and interest rates in Indonesia. The study used time-series data from 2008: Q1 - 2019: Q4 with SVAR approach. Based on the result there was a positive response from money demand to income shocks but a negative response to inflation and interest rate shocks. Income variable is volatile and contributes the most to money demand compared to inflation and interest rates.

Keywords: demand for money, macroeconomic variables, SVAR

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INTRODUCTION

Economic condition in developing countries is presumed vulnerable to crisis, particularly Indonesia. Thus, a study incorporated to macroeconomics and monetary conditions are considered crucial to be developed. One of studies that related to monetary policy is money demand. Money demand is described as currencies owned by people, demand deposit, quasi money owned by domestic private sectors and securities aside of stocks. Extensive definitions of money, in terms of monetary, pushes central bank (as monetary authority) to perform the control towards money supply and demand since it gives effect to general macroeconomic policies.

As it can be highlighted from the crisis in 1997 and global crisis in 2008, urges monetary authority, in this case Bank of Indonesia to perform possible policies adjustment to keep the stability of internal economy. The policies in monetary economics play important role in restoring the internal economic condition. The importance of money demand stability becomes the crucial agenda that is also influenced by the condition of macroeconomic in a country. Research that is incorporated to money demand has been performed by many previous researchers both from developed and developing countries.

Research by Prawoto (2000) on money demand and its influencing factors, uses macro variables that include income, interest rate and cost modification. For comprehensive result on money demand model, then broad money (M_2) and narrow money (M_1) are included. The research indicates that total wealth elasticity or permanent income is higher than interest rate elasticity and inflation, it specifies that numbers of on-hand money designated for transaction or preparation are higher than being used for speculative motive. Besides,

value of long-term parameter is broader than short-term parameter, which shows that in long-term, people will hold numerous of liabilities from the bank.

Determination of money demand function was developed by Widodo (2015), who employed GDP variable that is insignificant towards money demand, while variable of exchange rate and interest rate have influence towards money demand, in which the research uses narrow money (M_1). While, a research was conducted by Setiadi (2013) explained that PDB and inflation have positive influence towards money demand, either long-term and short-term, whereas interest rate has negative long-term influence towards money demand. It demonstrates that macroeconomic condition contributes to money demand in Indonesia.

The research on money demand has implication to policies that could be taken by Bank of Indonesia, whether employing money targeting or inflation targeting. The research was developed by James (2005) about demand for money in Indonesia by using time-trend as proxy originated from financial liberalization with data span of 1983-2000, which revealed the cointegration of M_2 with income and interest rate. The approach by using CUSUM and CUSUMQ test demonstrates the stable money demand model implicates that research from James (2005) supports money targeting as the monetary strategy for Bank of Indonesia. Whereas, the model developed by Kurniawan (2020) on money demand in Indonesia that employed quartal data of 2000-2019 using ARDL method (autoregressive distributed lag model), demonstrates the existence of cointegration using bound test. Stability test with CUSUM and CUSUMQ displays unstable model of demand for money implicates that research from Kurniawan (2020) supports the inflation targeting as monetary strategy for Bank of Indonesia.

Different technique was developed by Narayan (2007) that used Johansen Cointegration approach. It indicates the existence of long-term cointegration in model between demand for money and its influencing factors in Indonesia, while Hansen test approach was employed for stability test that demonstrates the instability of the model, referring to the research by Narayan (2007) that encourages inflation targeting as monetary strategy for Bank of Indonesia.

The importance of research on money demand also supported by study conducted by Folarin and Asongu (2019) that observed the importance of money demand stability, moreover due to the existence of deregulation policy of financial sector in Nigeria. It is stated in their study that the money demand in Nigeria is considered as stable with the presence of long-term relationship, according to the approach of CUSUM and CUSUMQ test. The implication of the study from Folarin and Asongu (2019) discovered that monetary policy with interest rate control was less effective in Nigeria.

Similar research related to demand for money was also conducted in developed country, such as Hwang (2002) in Korea and Baharumshah et al (2009) who revealed the existence of long-term relationship in money demand both in Korean and China. Baharumshah et al (2009) argued that interest rate has significant wealth effect towards money demand in both short-term and long-term.

This research is focused in interrelationship among macroeconomic variables, such as GDP as income proxy, inflation, interest rate level and demand for money with structural vector autoregressive (SVAR) approach. This method is used to test the transmission and shock effect of macroeconomic variables towards money demand. Bacchiocchi and Fanelli (2015) stated that SVAR model is used as policy analysis and

response of a variable towards shocks, as it is well aware that structural shocks are crucial to be identified as simulation for a policy. Magnussion and Mavroeidis (2014) in their research, demonstrated that structural change in macroeconomic could be employed in a constructive way to identify the relationship between structural and invariant time.

After crisis in 1997, there are many dynamic changes in monetary policy, such as monetary targeting and inflation targeting. A research by Narayan (2007), Kurniawan (2020) supported inflation targeting as the monetary strategy for Bank of Indonesia, while James (2005) demonstrated the divergent opinion to support monetary targeting to be implemented in Indonesia. This research is focused on money demand and its environment, such as the macroeconomic condition in a country. Considering on the importance of money demand role as transaction tools that could affect the people's buying power, therefore the influence of macroeconomic variables and their shocks give impacts to overall money demand. This research contributes the description of the importance of monetary policy with quantitative approach as well as the respond of money demand based on macroeconomic variables altogether with the shocks. To meet this purpose, SVAR approach is employed to analyze the policy. SVAR model is developed based on previous research theoretical background. Impulse response dan forecast error variance decomposition analysis is applied to describe the empirical findings of research. According to Arwatchanakarn (2017), SVAR model is more interesting and beneficial if compared to VAR model, since it can fit several economy theories and previous research, as well as identify the response of a variable once a shock is exposed to other variables.

THEORITICAL BACKGROUND

Income

The research developed by Prawoto (2000) detailed that income variable can be used to measure people's demand for money. Income variable refers to money demand theory developed by Keynes under following formulation:

$$M^d = f(Y, R, P^c)$$

In which M^d represents the demand for real money, Y represents the income, R is interest rate and P^c is price changes. The higher income, the higher expenses, hence the money demand will climb up.

The variable of Gross Domestic Product (GDP) is specified as income proxy as stated by Narayan (2007) who also used GDP variable as proxy of domestic income. The raising income could accelerate the transaction to enable positive relationship between income and money demand.

Inflation

According to Rahardja and Manurung (2004), inflation is defined as the constant raise of common goods. Inflation variable is used as the proxy of price changes. The changes on goods and services provide effect on people's consumption pattern that leads to the alteration of money demand.

Widodo (2015) suggested that inflation gives effect to money demand, based on crisis experience in Indonesia, the money demand increases swiftly to be withdrawn for transactions, mostly for preparation purposes.

Based on research by Bahmani-Oskooee and Gelan (2009), the inflation variable designated to describe the description of market as whole towards money demand. Particularly, for developing countries, which their financial sectors are still growing.

The level of Interest Rate

Another argument about the characteristics of money demand is the utilization of interest rate. Rao dan Kumar (2009) described that the utilization of

interest rate for developing countries becomes inappropriate when the money demand is stable. This research employs interest rate as the function of opportunity variables that can be employed as information for opportunity cost in holding the money, it indicates that the function of money demand becomes more sensitive than the interest rate changes, to obtain complete information and sensitive characteristics of money demand.

Narayan (2007) implied that interest rate has negative influence towards money demand, when the interest rate increases then the opportunity cost of holding money is also escalating. Bank of Indonesia uses interest rate as the policy instrument to interfere with the economic activities, which impacted to the demand for money.

The change of interest rate level that applied by Bank of Indonesia could encourage people's decision on what to be consumed, then the utilization of interest rate becomes important in the addition to the condition of a country, which applies interest rate as the monetary policy tool.

RESEARCH METHOD

Data Analysis Technique

To overcome shock-related problems on macroeconomic variables and money demand, then structural vector autoregressive (SVAR) approach can be applied. According to Khan and Ahmed (2011), SVAR model has better empirical appropriateness on macroeconomic model that enable the structural shock identification based on theory of economy. Chuku et al (2011) stated that SVAR allows the examination on unpredictable effect at one or more variables existed in a system/model.

SVAR model was first developed by Sims (1986) and Bernanke (1986) designed as the model of economic analysis, which tests the relationship between forecast error and structural shocks at variable n in VAR system.

General equation for SVAR is formulated, as follows:

$$A_0 Y_t = A_1(L)Y_t + B\varepsilon_t$$

In which, Y represents $(n \times 1)$ as vector of macroeconomic variable; A_0 and B is $(n \times n)$ vector of parameter; $A_1(L) = \sum_{i=1}^n A_{1i}L^i$ is polynomial matrix with lag; and ε_t is $(n \times 1)$ vector of structural shocks. On above equation, with A_0^{-1} as derivative of VAR equation, specifically could be written as follows:

$$Y_t = C(L)Y_t + \varepsilon_t$$

Then $C(L) = A_0^{-1}A_1(L)$; ε_t is derivative vector of residual value, in which $A_0^{-1}B\varepsilon_t$.

Therefore, SVAR system is incorporated with following equation:

$$A_0 e_t = B\varepsilon_t$$

In which A_0 is $(n \times n)$, a matrix among endogenous variables, B is $(n \times n)$ linier matrix related to residual value of SVAR towards structural innovation, e_t is derivative vector of residual value and ε_t is the vector of structural shock.

This research is focused on the condition of global financial crisis, which was happened in 2008Q1 – 2019Q4. The utilization of SVAR method is designated to analyze the response of a variable towards other variable shocks in a model. Entire research data are sourced from SEKI Bank of Indonesia. First step in estimating the time series data model is to perform stationarity test. The equation form for stationarity test uses ADF (Augmented Dickey Fuller) analysis, being tested at certain level or at first different, hence stationary data on a variable is eventually obtained.

The equation is formulated, as follows:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \beta_t \sum \Delta Y_{t-i+1} + e_t$$

In which:

ΔY_t = Form of first different

α_0 = Intercept

Y = Variable tested for its stationarity

t = Length of lag used in model

e_t = Error Term

If t-count value of ADF is bigger than critical value, then H_0 is rejected, which

indicates the absence of unit root problem on variable. On the contrary, if the value of t-count of ADF is smaller than critical value, then H_0 is accepted, which shows the presence of unit root problem on variable.

Later, vector of endogenous variable Y_t could be written, as follows:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_p y_{t-p} + \varepsilon_t$$

In which $t = 1, 2, 3$ represents the optimum lag length based on criteria of Final Prediction Error (FPE), Akaike Information Criterion (AIC) and Schwarz Criterion (SC). y_t is $m \times 1$ of endogenous variable vector and m represents the numbers of variable on vector. In this research, m equal to 4 (entire variables used in the model). The variables in SVAR method is defined as follows:

$$y_t = (JUB_t, PDB_t, INF_t, SB_t)$$

There are 4 structural shocks with JUB component as money demand variable, GDP as income proxy, INF proxy of cost change and SB, which is interest rate. The equation applied provides comprehensive explanation, as analytically, the economy with changes and structural shocks could be identified with theoretical approach. The component of shocks could be written, as follows:

$$\varepsilon_t = [\varepsilon_t^{JUB}, \varepsilon_t^{PDB}, \varepsilon_t^{INF}, \varepsilon_t^{SB}]$$

In which $E(\varepsilon_t) = I$, represents orthogonal matrix.

RESULT OF THE RESEARCH AND DISCUSSION

SVAR Method Analysis

1. Stationarity Test

Early stage in testing is by performing stationarity test over entire variables. The decision will be taken if the probability $ADF > 0,05$ then H_0 is accepted, if the probability $ADF < 0,05$ then H_0 is rejected. Following is the result of stationarity test:

Table 1
Stationarity Test of ADF

No	Variable	Level	Description
		P-ADF	

1	JUB	1,254	Non-Stationary
2	PDB	1,045	Non-Stationary
3	INF	1,944	Non-Stationary
4	SB	-2,451	Non-Stationary

Source: Processed Data

Above tested data, which are displayed in table, show that all variables are found as non-stationary at the level stage. Therefore, H_0 is accepted by all variables indicates the presence of unit root problem at level stage. Later, it needs integration using ADF at first difference level. Below is the result of ADF stationarity test with first difference:

Table 2
ADF Stationarity Test

No.	Variable	First Diff	Description
		P-ADF	
1	JUB	-3,660***	Stationary
2	PDB	-3,593**	Stationary
3	INF	6,352***	Stationary
4	SB	-4,380***	Stationary

Source: Processed Data

From data tested in Table 2, it indicates that entire variables are stationary at the first difference level. It is proven with the value of t-count that is greater than critical value of 5%. Then, it can be concluded that all variables are considered as stationary.

2. The determination of optimum lag

Table 3 demonstrates optimum lag located in the 4th lag, based on the criteria set by Final Prediction Error (FPE) and Akaike Information Criterion (AIC), Even though Schwarz Criterion (SC) approach indicates 1st lag. Thus, 4th lag is determined as the optimum lag for SVAR model

Table 3
Optimum Lag Test

Lag	FPE	AIC	SC
0	0,000328	3,328941	3,499562

1	3,78e-07	-3,442500	-2,589392*
2	3,36e-07	-3,587539	-2,051944
3	3,10e-07	-3,740805	-1,522723
4	1,52e-07*	-4,594885*	-1,694315

Source: Processed Data

3. Impulse Response Function (IRF)

In investigating the fluctuation of macroeconomic variables towards demand for money in Indonesia, then IRF approach is considered important to be applied to identify the respond of a variable on the existence of other variables' shocks. In this case to see the respond of money demand variable, once the shocks on macroeconomic variable occurred. Structural shock employs 10 periods in this research.

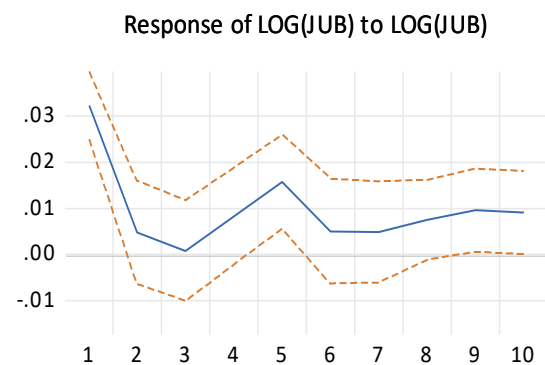


Figure 1

Responds of JUB towards JUB Shock

Figure 1 describes the variable of distributed money once the shock is exposed towards the variable itself or towards variable of distributed money, which will be positively responded from period one to 10 with no significant shock. It indicates the presence of shock on dependent or autoregressive variable. In terms of case in money demand shock toward its variables. it will respond fluctuated in short-term (Figure 1), as it can be seen that, for long-term, the respond towards shocks becomes more constant.

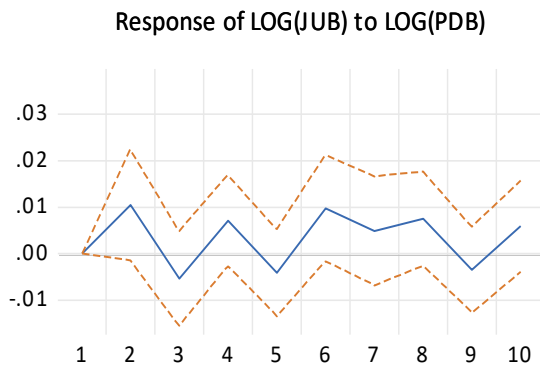


Figure 2
JUB Respond towards GDP Shock

Figure 2 describes the fluctuated response of distributed money when shock is occurred towards income variable. Fluctuated responses are constantly occurred both for short time and long-term, variable of distributed money responds positively on the first and the second period, then turns negative on third period, the next period for distributed money variable to have another positive response is recorded in the period of 6 to 8. By the end of 10th period, positive response on distributed money indicates that income has positive influence towards distributed money. It supports the research conducted by Kurniawan (2020), Narayan (2007), the raise of people's income will enhance the money demand that leads to transaction acceleration. It should be considered by the government, to balance the raise of income with people's need for money to avoid economic overheat. The imbalance between people's income with necessity will cause the inflation, even hyperinflation that could lead to the drastic decrease of buying power, which could trap the economy in crisis.

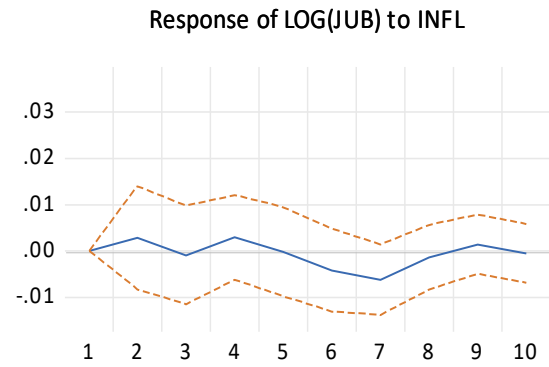


Figure 3
JUB Respond towards INF Shock

Figure 3 illustrates the response of distributed money variable when shock is occurred over inflation variable. Then, distributed money will respond positively started from the first period to the second period. Positive initial period indicates positive response, so when the price of goods and service arise, the needs of money will also increase. It is aligned with the research carried out by Widodo (2015) stated that short-term inflation gives positive influence. Yet, negative response on the distributed money variable towards inflation shock happens in the eighth period. It suggests that inflation shock could cause the decrease of money demand.

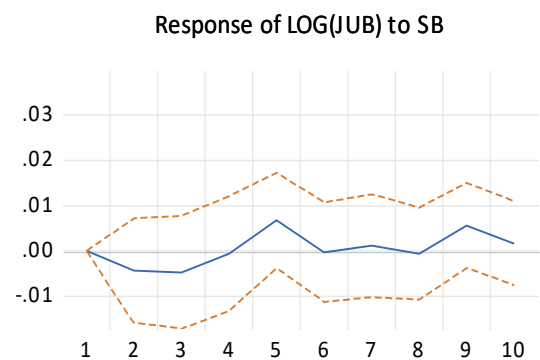


Figure 4
JUB Respond towards SB Shock

Figure 4 is the respond of distributed money variable when a shock towards interest rate happens. The distributed money will respond negatively in the first

period up to fourth period. It suggests that holding the money in cash leads to higher opportunity cost, if being compared to saving the money in the bank. This statement supports the research conducted by Prawoto (2000) and Narayan (2007) stated that interest rate has negative influence towards money demand.

The result of IRF on the entire four variables in SVAR system shows that the income variable plays the important role towards money demand response, as seen in Figure 2, the response of money demand is fluctuated consistently both in short-term and long-term. Thus, there are still possibilities for the impact of shocks from price change variables (INF) and interest rate, as it can be notified that shock on both variables gives enough fluctuated responses towards money demand.

4. Forecast Error Variance decomposition (FEVD) Test

The test of Forecast Error Variance Decomposition (FEVD) is applied to identify the proportion of each variable movement that covers: JUB, GDP, inflation and interest rate.

Table 4
Variance Decomposition

Period	LOG (JUB)	LOG (PDB)	INFL	SB
1	100.0	0.000	0.00	0.00
2	88.6	9.133	0.66	1.53
3	85.0	11.037	0.69	3.24
4	82.1	13.659	1.25	2.96
5	81.71	12.151	1.02	5.10
6	76.9	16.387	1.89	4.72
7	74.7	16.875	3.83	4.57
8	73.2	18.704	3.70	4.33
9	72.8	18.074	3.56	5.52
10	72.5	18.666	3.38	5.34

Source: Processed Data

Table 4 shows the result of variance decomposition with the early period of JUB variable volatility that is explained by its own variables in the amount of 100%. Income variable that uses proxy of GDP variable also shares large volatility, in addition to JUB, which contributes up to 18,7% towards demand for money. While, the variable of interest rate contributes 5,34% volatility to JUB variable. Whereas, the variable of inflation shares volatility up to 3,83% that contributes to JUB variable.

In the case of money demand developed by SVAR system, it shows that in the short-term, money demand and income volatility contribute the most, yet for long-term, the variables of inflation and interest rate contribute the volatility. The utilization of macroeconomic variables, such as income (GDP), price change (INF) and interest rate contribute the demand for money volatility in Indonesia.

CONCLUSION AND SUGGESTION

Conclusion

The SVAR approach is applied in this research, which is aimed to investigate the shock on macroeconomic variables (GDP, inflation and interest rate) and how is the respond of demand for money (JUB) against the shock.

The result of research indicates, when the shock happens to income variable (GDP), it will be responded positively by JUB. This statement supports the studies conducted by Kurniawan (2020), Narayan (2007) suggested that the raise of people's income will enhance the money demand and could possibly accelerate the transaction.

The shock on inflation variable will be responded positively in the early period, it supports the research performed by Widodo (2015) stated that inflation in short-term has positive influence, it suggests that the arise of goods and services will trigger the increase of

the needs of money, but for the long-term it will be responded negatively due to high price change will lead to people's reluctance for consumption.

Negative response on money demand occurs when the shock of interest rate variable shows that cash money holder will cause higher opportunity cost than saving it in the bank, which is aligned with the research carried out by Prawoto (2000) and Narayan (2007) suggested that interest rate influences demand for money, negatively.

The result of variance decomposition shows that income variable has volatility and contributes on money demand for 18,7%, inflation variable for 3,83% and interest rate for 5,34%. The movement proportion of macroeconomic variables shows that money demand highly depends on economic condition of a country.

The implementation of policy, which is conducted by monetary authority, in this case Bank of Indonesia, applies inflation targeting that is presumed as correct, if being compared with monetary targeting. Several disadvantages of monetary targeting; first it depends on stable relationship between money and inflation. The research found that the response of money demand towards inflation happens in fluctuated manner, due to the existence of positive and negative phase. Secondly, the presence of disruption on outflow and inflow and instability on money demand.

Suggestion

Based on the findings, this research provides suggestions, as follows:

1. For government, it needs to improve the Gross Domestic Product, the growth of GDP will cause more distributed money or distributed widely. It describes the intensification of people's welfare. This welfare leads to the increase of people's saving and investment. Hence, in the

short-term and long-term, the economic growth will be enhanced. The enhancement of people's income should be performed with precaution, since high distributed money will cause inflation, therefore government should maintain the stability of low inflation level. It refers to the interest rate that could be set in the low level to enable low credit interest rate. This will encourage the investors to invest.

2. Bank of Indonesia needs to set balanced interest rate as monetary policy; hence the interest rate can be advantageous to consumers, producers and investors.
3. The decision makers, both government and monetary authorities should keep the internal economic condition to be more stable and robust, to specifically has less effect towards money demand that potentially could interfere with the stability of domestic demand for money.

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